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I. Introduction

Climate change is the most wicked problem of our time. A "wicked problem" is a planning term used to describe an issue resistant to resolution. Wicked problems are difficult to solve due to incomplete, contradictory, and changing requirements that often reveal additional obstacles once work has begun.[1] A problem becomes wicked when it is well recognized that action must be taken to avoid future catastrophic events yet traditional problem solving techniques fail to produce solutions.[2]

Scientists are certain the climate is changing at an increasing rate that can only be attributed to human influences, mainly the burning of fossil fuels. As the earth's atmosphere and oceans warm, sea levels will rise, extreme weather events will occur, wildfires will break out, rivers will flood, agriculture will suffer, lives will be lost, and species, unable to adapt to these fast paced changes, will go extinct. The United States, along with the rest of the world, has already begun to feel these impacts. It is time for federal, state, and local, governments to act.

Instances of adaptation planning currently exist at the federal and state level; however, not all areas of the country are preparing for the impacts of climate change, and some that are have not done enough. The federal government needs to articulate clear standards for adaptation planning that encourage and coordinate state efforts. Given the current state of Washington, it is unlikely that new legislation will be passed. Therefore, existing laws should be examined for ways in which they may be repurposed or amended to contribute to adaptation planning. Looking at available regulations, the Coastal Zone Management Act (CZMA) provides a good

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1. Rittel and Webber, *Dilemmas in a General Theory of Planning*, 4 POLICY SCIENCES, 155-169 (1973) (describing the concept of wicked problems).

2. Kelly Levin et al., *Overcoming the Tragedy of Super Wicked Problems: Constraining our Future Selves to Ameliorate Global Climate Change*, 45 POLICY SCIENCES, 123-152 (2010) (characterizing climate change as a "super wicked" problem).

starting point for a land use statute that may be restructured for coastal adaptation. Adaptation will have to be implemented across numerous sectors and will likely require the revision of several laws, but addressing climate change impacts in the coastline will be a key piece.

This paper explores how the CZMA may be repurposed or amended to further adaptation planning. It has four parts. Following the introduction, Part II provides a summary of climate change impacts and a discussion of the need for both mitigation and adaptation, with a focus on adaptation measures. Part II finishes with a summary of federal and state efforts to adopt adaptation plans to date. Part III analyzes whether the CZMA could be amended or repurposed to include adaptation planning. The section begins with a summary of four principles for effective adaptation planning followed by an overview of the Act. Part III then discusses the ways in which the CZMA currently meets the four adaptation principles, the ways it could be repurposed to meet them, or areas that will have to be amended for the CZMA to become a comprehensive and effective adaptation plan. Part IV concludes and calls on The National Oceanic and Atmospheric Administration (NOAA) and Congress to effectuate these changes so that adaptation planning in the United States can gain the traction that it needs, and we can begin contending with this wicked problem.

II. Climate Change Impacts and Responses

The following section summarizes the most recent scientific research on the impacts of climate change. It then discusses the various governmental responses that address these impacts, followed by a summary of adaptation initiatives already underway at the federal and state level.

A. Climate Change Impacts

The scientific community is certain that climate change is occurring at levels beyond the adaptability of the earth's natural system.[3] Brought on by human industrial activity in combination with natural fluctuations in the earth's temperature, climate change has already begun impacting the environment.[4] While the extent of these impacts is uncertain, it is clear that we need to begin planning for environmental change.

3. *See generally* EPA, *Climate Change: Basic Information*, (Mar. 18, 2014), http://www.epa.gov/climatechange/basics/.

4. *See generally* Intergovernmental Panel On Climate Change, Climate Change 2013: The Physical Science Basis, Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2013) [hereinafter IPCC 2013], available at http://www.ipcc.ch/re port/ar5/wg1/ (describing global impacts); United States Global Change Research Program,

The planet is warming at a rate that can only be explained by human influences.[5] Humans emit staggering levels of carbon dioxide, methane, nitrous oxide, and other greenhouse gasses, primarily from the burning of fossil fuels and from deforestation.[6] As the U.S. Global Change Research Program (USGCRP) states: "Global annual average temperature has increased by more than 1.5°F since 1880 (through 2012)."[7] In the United States the annual temperature has increased by 1.3°F to 1.9°F and the most recent decade was the warmest in history.[8]

Scientists have determined that past greenhouse gas emissions have set in motion "climate inertia," a series of changes that will occur regardless of future reductions because of the long-lived nature of these climate pollutants.[9] Even if all emissions from human activities suddenly stopped, the earth would continue to warm another 0.5°F.[10]

As the global temperature rises, the earth's atmosphere and oceans warm, causing seawater to expand and sea levels to rise. Sea level rise is, and will be, one of the most detrimental impacts of climate change. The USGCRP reports that to date, across the globe the sea level has risen approximately 8 inches[11] and the rate at which oceans are rising has roughly doubled the rate observed over the last century.[12] Looking ahead, by 2100, "projections show that even for lowest emission scenarios, thermal expansion of ocean waters and the melting of small glaciers will result in 11 inches of sea level rise."[13] Sea level rise will vary based on the prevailing winds, changes in ocean

Climate Change Impacts in the United States (2014) [hereinafter USGCRP 2014], *available at* http://nca2014.globalchange.gov/ report (describing U.S. impacts).

5. Natural drivers of climate change cannot explain recent global warming, the majority of warming over the last fifty years can only be explained by human influences as demonstrated by multiple lines of independent evidence. USGCRP 2014, *supra* note 4 at 23.

6. USGCRP 2014, *supra* note 4 at 23.

7. I*d*.

8. I*d*. at 28.

9. I*d*.

10. USGCRP 2014, *supra* note 4 at 25 (discussing how "choices made now and in the next few decades will determine the amount of additional future warming").

11. USGCRP 2014, *supra* note 4 at 44.

12. I*d*.

13. I*d*. at 45.

currents, changes in polar ice sheets, and subsiding or rising land levels that effect a given region.[14] Nevertheless, nearly all regions will be impacted.

Sea level rise will have numerous consequences, eroding seashore, submerging lands, inundating wetlands, and contaminating freshwater drinking supplies with salt.[15] Stronger storms and higher storm surges will also lead to severe flooding and erosion.[16] The rising sea increases off shore ocean depth, which in turn allows storms to come within closer proximity to land before an ocean-born hurricane's brute force is released.[17] Additionally, as explained by Professor Chad McGuire, "warming ambient surface temperatures increase the temperature of surface waters, which in turn increase the intensity of [these] storms."[18] The combined effect produces super storms like Hurricane Katrina and Hurricane Sandy.

In 2005, Hurricane Katrina killed 1,300 people, displaced 770,000 people,[19] and caused $125 billion in damage.[20] In 2012, Hurricane Sandy

14. Michael Lemonick, *The Secret of Sea Level Rise: It Will Vary Greatly by Region*, YALE ENVIRONMENT 360 (March 2010), *available at* http://e360.yale.edu/feature/the_secret_of_sea_level_rise_it_will_vary_greatly_by_region/2255/.

15. USGCRP 2014, *supra* note 4 at 44.

16. Chad J. McGuire, "*Climate Change and the Coastal Zone Management Act: The Role of Federalism in Adaptation Strategies*" CLIMATE CHANGE IMPACTS ON OCEAN AND COASTAL LAW: U.S. AND INTERNATIONAL PERSPECTIVES. Ed. Randall S. Abate. New York: Oxford University Press, 2015. 419-437 at 423 [hereinafter McGuire]; Hurricane Sandy produced record breaking storm surge with waive heights at 13.88 feet (4.23 m). Live Science, *Hurricane Sandy Smashes Ocean Wave Records*, (November 2012) *available at* http://www.livescience.com/24790-hurricane-sandy-wave-record.html.

17. McGuire, *supra* note 16 at 423.

18. McGuire, *supra* note 16 at 423; Christopher B. Field et al., *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, 76-89 (2012) *available at* http://ipcc-wg2/SREX/images/uploads/SREX-All_FINAL.pdf.

19. Peter Byrne and Jessica Grannis, *Coastal Retreat Measures*, in *The Law of Adaptation to Climate Change*, 267, 267 (Michael Gerald and Katrina Kud ed., 2012) [hereinafter Byrne and Grannis].

20. Knabb et al., *Tropical Cyclone Report: Hurricane Katrina*, National Hurricane Center 1, 13 (December 2005) [hereinafter Knabb], *available at* http://www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf.

killed 117 people,[21] left more than 2.7 million people without power,[22] and caused $67 billion in damage.[23]

Storms like these are occurring not only with greater intensity but also with greater frequency.[24] NOAA has observed that "[t]he number of natural events that inflict at least $1 billion in damage has risen from an average of two per year in the 1980s to more than ten per year since 2010."[25]

Climate impacts will be felt throughout the country, but some of the most dramatic effects of climate change will occur along the coast.[26] In 2010, NOAA determined that 123.3 million people, or 39 percent of the United State's population lived in counties directly on the shoreline.[27] This is where Professor Robert Verchick and Dr. Joel Scheraga caution, "the twin threats of rising seas and stronger storms are already mounting the beaches . . . and . . . where most Americans, along with billions of dollars in cultural and commercial assets[,] currently reside."[28]

21. CNN, *Hurricane Sandy Fast Facts*, (November 2015) http://www.cnn.com/2013/07/13/world/americas/hurricane-sandy-fast-facts/.

22. FEMA, *6 Months Report: Superstorm Sandy from Pre-Disaster to Recovery*, (April 2013) http://www.fema.gov/disaster/4086/updates/6-months-report-superstorm-sandy-pre-disaster-recovery.

23. Blake et al., *Tropical Cyclone Report Hurricane Sandy*, National Hurricane Center (October 2012) http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf.

24. USGCRP 2014, *supra* note 4 at 41.

25. National Climate Data Center, *Billion-Dollar Weather and Climate Disaster: Table of Events*, (April 12, 2015) *http://www.ncdc.noaa.gov/billions/events*. *See also* Brad Plumer, *The Government is Spending Way More on Disaster Relief Than Anybody* Thought, WASH. POST (April 2013) http://www.washingtonpost.com/blogs/wonkblog/wp/2013/04/29/the-government-is-spending-way-more-on-disaster-relief-than-anybodythought/.

26. A coastal area's vulnerability to flooding and erosion caused by sea-level rise and storm surge depends largely on elevation. Coastlines with more gentle gradients in the slope of their land are most susceptible to inundation. For example, along the Gulf Coast, eastern seaboard, and southern California. USGS, *Sea-Level Rise Hazards and Decision Support: Coastal Elevation Data*, (November 2014) http://wh.er.usgs.gov/slr/coastelevations. html.

27. This population is expected to increase by eight percent from 2010 to 2020. NOAA, *What Percentage of the American Population Lives Near the Coast?*, (February 2014) http://oceanservice.noaa.gov/facts/population.html; USGCRP 2014, *supra* note 4 at 44.

28. Robert Verchick and Joel Scheraga, *Protecting the Coast*, in *The Law of Adaptation to Climate Change*, 235, 235 (Michael Gerald and Katrina Kud ed., 2012) [hereinafter Verchick and Scheraga].

Climate change will produce a host of other problems. To begin with, a warmer climate will paradoxically increase the frequency of both droughts and flooding. The U.S. Global Change Research Program (USGCRP) predicts that in the United States and throughout the world, "the wet areas will get wetter and the dry areas will get drier."[29] Extreme precipitation events will occur more frequently and with greater intensity. "During the past century, the amount of precipitation falling in the heaviest one percent of rain events increased nearly 20 percent."[30] These events are predicted to occur every four to fifteen years compared to the previous rate of one every twenty years.[31] Such dramatic rainfall results in flash flooding, which has become the leading cause of death attributed to weather.[32]

The United States has also begun to experience intense periods of drought. As of November 2014 nearly thirty percent of the country was in at least a moderate drought.[33] California experienced a particularly bad dry spell that forced the state to adopt emergency measures to reduce water consumption.[34] Climate data suggests that in general, the country is in the midst of one of its most sustained periods of drought on record.[35]

Heat waves have similarly become more frequent across the United States. The Palmer Index, a collection of United States drought data, reports that, "the Summer (June-August) temperatures of 2012 ranked in the hottest 10 percent of the 118-year period in record in 28 states covering the Rocky Mountain states, the Great Plains, the Upper Midwest, and the Northeast."[36] In other parts of the country the heat is driving wildfires.[37] In 2012, the United

29. USGCRP, U.S. P*recipitation Change*, 33.

30. Verchick and Scheraga, *supra* note 28 at 236.

31. I*d*.

32. USGCRP 2014, *supra* note 4 at 40.

33. Mike Bostock and Kevin Quealy, M*apping the* S*pread of the* D*rought* A*cross the* U.S., N.Y. TIMES (December 4 2014) http://www.nytimes.com/interactive/2014/upshot/mapping-the-spread-of-drought-across-the-us.html?_r=0&abt=0002&abg=1.

34. State Water Resources Control Board Resolution No. 2014-0038, *available at* http://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2014/rs2014_0038_regs.pdf.

35. NOAA, C*limate of* 2013-A*pril* U.S. P*almer* D*rought* I*ndices*, National Climate Data Center (May 2013), *available at* http://www.ncdc.noaa.gov/oa/climate/research/prelim/drought/palmer.html. Tree ring data also suggests that the drought over the last decade in the western U.S. represents the driest conditions in 800 years. USGCRP 2014, *supra* note 4 at 38.

36. USGCRP 2014, *supra* note 4 at 38.

37. I*d*.

States witnessed record outbreaks of wildfires, which deteriorated ecosystems, human settlement, and air quality.[38]

Winter storms have also increased in force and frequency. The USGCRP reports, "Extremely heavy snowstorms increased in number during the last century in northern and eastern parts of the United States."[39] In some areas, such as the Sierra Nevada, snow is melting earlier in the year, and more precipitation is falling as rain instead of snow.[40] These changes in snowpack reduce the amount of water available in the summer, which in turn affects agriculture.[41]

Finally, increasing atmospheric temperatures will increase ozone air pollution, thereby deteriorating air quality and impacting human health.[42] Existing ecosystems will also be affected. Many animals are unable to adapt at a rate that is competitive with that of the changing climate, and those unable to keep up will be driven to extinction.[43]

38. *See e.g.*, Pete Spotts, *Monster Wildfires in Arizona*: A *Glimpse of What Climate Change Could Bring*, CHRISTIAN SCIENCE MONITOR (June 9, 2011) http://www/csmonitor.com/Environment/2011/0609/Monster-wildfire-in-Arizona-A-glimspe-of-what-climate-change-could-bring. Darryl Fears, *Colorado's Table Was Set for Monster Fires*; WASH POST (July 1, 2012) *available at* http://www.washingtonpost.com/national/health-science/colorados-table-was-set-for-monster-fire/2012/07/01/ gJQAVa6cGW_story.html.

39. USGCRP 2014, *supra* note 4 at 43.

40. *Id.*

41. The California Climate Change Center, *Our Changing Climate: Assessing the Risks to California*, 1, 8 (July 2006), *available at* http://meteora.ucsd.edu/cap/pdffiles/CA_climate_Scenarios.pdf.

42. EPA, *Our Nations Air-Status and Trends through* 2010, (October 2014) http://www.epa.gov/airtrends/2011/.

43. Intergovernmental Panel on Climate Change. Climate Change 2007: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007) [hereinafter ICPP 2007]. "There is medium confidence that approximately 20-30% of species assessed so far are likely to be at increased risk of extinction if increases in global average warming exceed 1.5-2.5°C (relative to 1980-1999). As global average temperature increase exceeds about 3.5°C, model projections suggest significant extinctions (40-70% of species assessed) around the globe." Experts predict that one-fourth of Earth's species will be headed for extinction by 2050 if the warming trend continues at its current rate. The Nature Conservancy, *Climate Change Impacts: Wildlife at Risk*, (February 2015) http://www.nature.org/ourinitiatives/urgentissues/global-warming-climate-change/threats-impacts/wildlife-at-risk.xml.

B. Climate Change Responses

How can we put a stop to climate change? Society is facing a complex problem that is still not entirely understood. No single act can reverse the effects of climate change, but if both mitigation and adaptation policies are adopted immediately, we may slow and lessen the impending harms.

1. Mitigation

Mitigation strategies target the source of climate change by aiming to reduce the level of greenhouse gases in the atmosphere.[44] In 2009, President Obama announced that by 2020, America would reduce its greenhouse gas emissions in the range of seventeen percent below 2005 levels, if all other major economies agreed to limit their emissions as well.[45] The President continues to stand by this goal and the United States has adopted a number of mitigation policies. Under the Clean Air Act, the federal government has proposed New Source Performance Standards that will set carbon dioxide emission rates for existing power plants.[46] These regulations will set different target emissions rates for each state and allow them considerable flexibility in the design of their implementation plans. In addition, the federal government has proposed rules for new power plants that will prohibit newly built coal-fired plants unless they employ carbon capture-and-storage technology.[47] Altogether, the proposed state emission rates will yield a thirty percent cut in emissions from 2005 levels by 2030.[48]

44. Center for Progressive Reform, *Climate Change and the Puget Sound: Building the Legal Framework for Adaptation*, 3, 15 (June 2011), [hereinafter Center for Progressive Reform], *available at* http://www.progressivereform.org/articles/puget_sound_adaptation_1108.pdf.

45. *See generally* Executive Office of the President, *The President's Climate Action Plan*, (June 2013), *available at* http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.

46. Federal Register, *A Proposed Rule by the Environmental Protection Agency: Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units*, (June 2014), *available at* https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating.

47. Center for Climate and Energy Solutions, EPA *Regulation of Greenhouse Gas Emissions From New Power Plants*, (June 2014) http://www.c2es.org/federal/executive/epa/ghg-standards-for-new-power-plants.

48. U.S. Environmental Protection Agency, "Clean Power Plan Proposed Rule," last modified June 19, 2014, accessed June 19, 2014, *available at*

The federal government has also taken action to strengthen the fuel efficiency standards for vehicles.[49] President Obama has directed the National Highway Traffic Safety Administration and the Environmental Protection Agency to develop and issue a second phase of medium- and heavy-duty vehicle fuel efficiency and greenhouse gas standards by March 2016.[50] The Energy Independence and Security Act also imposed a federal renewable fuel standard, known as RFS2, which requires that fuel sold in the transportation sector include a certain amount of renewable biofuel.[51]

In addition to federal initiatives, states have begun taking action by setting regional greenhouse gas reduction limits, increasing renewable energy generation, and promoting energy efficient vehicles, buildings, and appliances. For example, twenty-seven states and the District of Columbia have established mandatory Renewable Portfolio Standards (RPS), policies that require a certain percentage or amount of electricity to be generated from eligible renewable sources by a given date.[52] Twenty-six states have Energy Efficiency Resource Standards (EERS), which establish targets for utilities to increase energy savings from electricity and/or heating fuels by a specified amount over time.[53]

Several states are also in the process of implementing low-carbon fuel standards for the transportation industry. In 2010 California adopted a low-carbon fuel standard, which set a goal of reducing the life-cycle carbon intensity of transportation fuels by a minimum of 10 percent by 2020.[54] Altogether, the federal and state government has begun the daunting task of reducing the country's greenhouse gas emissions. However, while mitigation

http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule.

49. EPA, *Regulations & Standards: Heavy—Duty*, (January 2015), *available at* http://www.epa.gov/otaq/climate/regs-heavy-duty.htm.

50. The White House, *Improving the Fuel Efficiency of American Trucks: Bolstering Energy Security, Cutting Carbon Pollution, Saving Money and Manufacturing* Innovation, (February 2014), *available at* http://www.whitehouse.gov/sites/default/files/docs/finaltrucksreport.pdf.

51. In 2010 the volume standard was set at 13 billion gallons of biofuels and will rise to 23 billion gallons by 2022. Department of Ecology State of Washington, *Washington Policies to Reduce Greenhouse Gas Emissions*, (November 2012) http://www.ecy.wa.gov/climatechange/docs/ccp_ appendix2.pdf.

52. Center for Climate and Energy Solutions, *Climate Change* 101:*State* Action, (January 2011) http://www.c2es.org/docUploads/climate101-state.pdf.

53. *Id.*

54. California Environmental Protection Agency, Air Recourses Board, *Low Carbon Fuel Standard* Program, (January 2015), *available at* http://www.arb.ca.gov/fuels/lcfs/lcfs.htm.

is an important component of the climate change battle, it will not be enough on its own.

Reducing greenhouse gas emissions in the United States will take years. Furthermore, countries like China and India need to curb their emissions before the globe can begin to recover. As the U.S. Climate Research Agency has cautioned: "Choices made now and in the next few decades will determine the amount of additional future warming."[55] Given the political challenges mitigation policies face, as well as the realities of climate inertia, society must begin focusing equal attention on adapting to climate change.

2. Adaptation

Adaptation refers to "adjustment[s] in natural or human systems in response to actual or expected climate stimuli or their effects."[56] Through proactive, or previously planned reactive measures, adaptation plans aim to lessen the magnitude of climate impacts.[57]

Planning for climate change is problematic. While there is an overwhelming consensus that change is occurring, the extent and timing of climate impacts remains uncertain.[58] Scientists have been able to develop global scale climate models, but struggle to downsize these simulations to a regional level.[59] Climate change also undermines the reliability of historical data, making projections, such as the extent and timing of seasonal hurricanes, droughts, and floods, unclear.[60]

There are three ways to respond to climate change impacts on the coastline: protection, accommodation, and retreat. Protection strategies use hard-engineered structures such as levees and seawalls to armor the coastline from storm surge, flooding, and erosion. Alternatively, the coastline may be sheltered from these impacts with ecosystem-based approaches, such as the restoration or preservation of wetlands.[61] Accommodation strategies

55. USGCRP 2014, *supra* note 4 at 25.

56. IPCC 2007, *supra* note 43 at 101.

57. Center for Progressive Reform, *supra* note 44 at 15.

58. Center for Progressive Reform, *supra* note 44 at 15; USGCRP 2014, *supra* note 4 at 22-24.

59. Center for Progressive Reform, *supra* note 44 at 15.

60. I*d*.

61. NOAA Digital Coast, U*nderstand*—C*onserving Coastal* W*etlands for* S*ea* L*evel* R*ise* A*daptation*, (February 2015) http://coast.noaa.gov/digitalcoast/wetlands/understand. Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater, and flood waters and distribute these waters more slowly over the floodplain, thereby lowering flood heights and dissipating storm surge. Large amounts of wave energy and

incorporate climate resilient features into building design, such as placing a house on stilts. Lastly, retreat strategies move development out of coastal areas vulnerable to sea-level rise and flooding.

Historically, communities have favored protection and accommodation strategies because landowners are reluctant to give up property, even when it is located in high-risk areas.[62] The problem with these structural adaptation policies is that buildings have been armored and fitted for current rates of sea level rise. These systems will not remain effective if there are significant increases in the rate of the rising sea or in the event of future super storms.[63] Additionally, continuing to build in the coastline interferes with opportunities to restore natural barriers. Wetland restoration is an effective means of armoring the coastline against flooding and storm surge, but is obstructed when human infrastructure remains in the coast or when wetlands are filled for development.

The risks caused by climate change will require the use of all forms of coastal adaptation, including retreat. Retreat measures can be adopted retroactively or proactively. In the wake of a hurricane or flood the government may prohibit landowners from rebuilding within a certain distance to the beach. These retroactive policies are met with less resistance because citizens have seen first hand the destruction that can be wrought. Proactive policies face greater opposition because the government must "preemptively regulate" by prohibiting new development in vulnerable areas.[64] Although less popular, these are exactly the forward thinking plans we need if coastal land, ecosystems, infrastructure, and human lives are to be protected.

C. Current Federal and State Adaptation Initiatives

In 2009, President Obama passed Executive Order 13514, which established the Interagency Climate Change Adaptation Task Force (Task Force), a committee created to develop recommendations for the President on how the federal government can strengthen policies and programs to

water from storms that may otherwise do extensive inland damage are absorbed by coastal wetlands. Some research indicates that the height of storm surge can be reduced by one foot for every mile of vegetative wetlands that exists. Wetland vegetation stabilizes the shoreline by holding sediments in place with roots, absorbing wave energy, and breaking up the flow of stream or river currents.

62. Byrne and Grannis, *supra* note 19 at 270.

63. I*d*. at 269.

64. I*d*.

better prepare the nation for the impacts of climate change.[65] The Task Force included the White House Council on Environmental Quality, the White House Office of Science and Technology Policy, the National Atmospheric Administration, and representatives from 20 federal agencies. The Task Force released Progress Reports recommending key components to include in a national strategy on climate change adaptation. The reports also provided updates on federal adaptation actions including initiatives to build resilience in local communities, efforts to safeguard freshwater, and programs that provide climate information and tools to help decision-makers manage climate risks. Executive Order 13514 also required federal agencies to develop Agency Adaptation Plans and provide them to the Council on Environmental Quality (CEQ) and Office of Management and Budget (OMB). These plans evaluated the most significant climate change-related risks and outlined actions the agencies would take to manage these vulnerabilities.

In 2013, President Obama replaced the Interagency Climate Change Adaptation Task Force with Executive Order 13653, which created the Council on Climate Preparedness and Resilience (Council).[66] The Council is comprised of representatives from across the federal government and is working to integrate climate resiliency into federal programs; provide information, data, and tools, for the public; and update the agency adaptation plans annually. The Executive Order also creates a State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience to inform federal efforts.

The Task Force created a *Climate Resilience Toolkit* that provides federal tools that can directly help planners and decision makers across the country conduct their work on climate change.[67] In addition, the Task Force solicited input from the states and provided recommendations on how the federal government can modernize programs and policies to incorporate climate change, incentivize and remove barriers to community resilience, and provide useful information and tools.[68]

65. Exec. Order No. 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, (Oct. 5, 2009), *available at* https://www.whitehouse.gov/assets/documents/2009fedleader_eo_rel.pdf.

66. Exec. Order No. 13653, *Preparing the United States for the Impacts of Climate Change* (Nov. 1, 2013) [hereinafter Exec. Order No. 13653], *available at* https://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change.

67. U.S. Climate Resilience Toolkit (April 12, 2015) http://toolkit.climate.gov.

68. President's State, Local, and Tribal Leaders Task Force On Climate Preparedness and Resilience, *Recommendations to the President*, (November 2014),

Under the order, federal agencies were required to release Climate Adaptation Plans to the general public, outlining strategies to reduce the vulnerability of federal programs, assets, and investments to the impacts of climate change.[69] In addition, these reports describe how agencies will achieve the environmental, economic, and energy goals mandated in Executive Order 13514. These plans must be updated each year and approved by the CEQ and OMB to ensure actions align with recourses, Administration priorities, the federal budget, and are based on a positive return on investment for the American taxpayer.

In addition to acting pursuant to the President's executive orders, some federal agencies have undertaken their own climate change initiatives. The USGCRP coordinates and integrates federal research on global climate change. Most notably, the USGCRP publishes the National Climate Assessment—a report summarizing the impacts of climate change on the United States, now and in the future. Since 2010, the Department of Defense (DOD) has listed climate change as a threat to national security.[70] Now in 2014, the DOD developed a *Climate Adaptation Roadmap* that details how climate change will affect the agency's operations, how the department will adapt to and mitigate these threats, and how the department will coordinate action with other agencies.[71]

The U.S. Environmental Protection Agency (EPA) is playing a part by requiring each of its regional offices to write draft implementation plans that address the impacts of climate change on its mission, operations, and programs, in coordination with the agency-wide Draft Climate Change Adaptation Plan.

In September 2014, the U.S. Department of Housing and Urban Development (HUD) launched the National Disaster Resilience Competition

available at https://www.whitehouse.gov/sites/default/files/docs/ task_ force_report_0.pdf.

69. U.S. Global Change Research Program, *Federal Adaptation Recourses: Federal Agency Adaptation* Plans, (February 2015), *available at* http://www.glo balchange.gov/browse/federal-adaptation-resources.

70. Council on Foreign Relations, *Department of Defense: Quadrennial Defense Review*, (March 2014) *available at* http://www.cfr.org/defense-budget/ department-defense-quadrennial-defense-review-report/p9772.

71. Council on Foreign Relations, *Department of Defense: Climate Adaptation Roadmap*, 2014, (October 2013), *available at* http://www.cfr.org/climate-change/ department-defense-climate-change-adaptation-roadmap-2014/ *p*33607.

(Competition).[72] This program makes $1 billion[73] available to communities that have been struck by natural disasters in recent years. The Competition "responds to requests from states, local, and tribal leaders who have asked the federal government to help them prepare their communities for the impacts of climate change and support investment in more resilient infrastructure."[74] The Competition "promotes risk assessment and planning and will fund the implementation of innovative resilience projects to better prepare communities for future storms."[75]

All states with counties that experienced a Presidentially Declared Major Disaster in 2011, 2012, and 2013 are eligible to submit applications to the competition and will need to tie their proposals to the disaster from which they are recovering.[76] HUD will partner with the Rockefeller Foundation, which will provide technical assistance to eligible communities with the development of recovery initiatives. The six winning projects will serve as examples of how the federal government can help support communities recovering from disasters.[77]

As for the states, fourteen have adopted state-led climate action plans.[78] In 2009, California released a comprehensive state wide Climate Adaptation Strategy that summarizes climate change impacts and recommends adaptation goals for seven sectors: public health, biodiversity and habitat, oceans and coastal recourses, water, agriculture, forestry, and transportation and energy.[79] In July 2014, California released an update highlighting the

72. The Rockefeller Foundation, HUD L*aunches* $1 B*illion* N*ational* D*isaster* R*esilience* C*ompetition*, (September 2014), *available at* http://www.rockefeller foundation.org/newsroom/hud-launches-1-billion-national.

73. Disaster Relief Appropriations Act, 2013 (PL 113-2), appropriated $16.0B ($15.2B post-sequester) to HUD in CDBG-DR funds for disaster relief, long-term recovery, restoration of infrastructure and housing, and economic revitalization. By law, these funds are limited to addressing Presidentially Declared Disasters from 2011-2013. HUD has until September 2017 to obligate all funds.

74. The Rockefeller Foundation, *supra* note 72.

75. I*d*.

76. The Rockefeller Foundation, *supra* note 72. This includes 48 of 50 states plus Puerto Rico and Washington D.C.

77. The Rockefeller Foundation, *supra* note 72.

78. Georgetown Climate Center's Adaptation Clearing House, S*tate and* L*ocal* A*daptation* Plans, (February 2015), http://www.georgetown climate.org/ adaptation/state-and-local-plans.

79. Georgetown Climate Center's Adaptation Clearing House, C*alifornia* C*limate and* E*nergy* P*rofile*, (February 2015) http://www.georgetown climate.org/

progress it has made implementing the plan, and outlining new and refined adaptation goals.[80] Altogether, California and Massachusetts have the greatest number of adaptation goals in place.[81]

In 2012, Washington completed the document, *Preparing for a Changing Climate: Washington State's Integrated Climate Change Response Strategy*, which lays out a framework to protect the state's natural resources and economy from the impacts of climate change.[82] The plan calls on state agencies to make climate adaptation a standard part of agency planning. It also encourages agencies to make scientific information about climate impacts available to decision makers in the public and private sectors.

New York, through the New York State Climate Action Council, created the Interim Report that outlines measures to reduce emissions and prepare for the impacts of climate change.[83] The Interim Report was released for public comment but a final plan has not yet been adopted or officially endorsed. In 2013, New York City, under the direction of Mayor Bloomberg, launched A *Stronger More Resilient New York*, a plan proposing more than 250 initiatives to reduce the city's vulnerability to coastal flooding, backed by $19.5 billion in funding.[84] Eighty percent of that funding will go to repairing homes and streets damaged by Hurricane Sandy, retrofitting hospitals and electrical infrastructure, and improving subway systems. The rest will be spent on floodwalls, restoring swamplands and sand dunes, and other coastal flood protections.

adaptation/state-information/overview-of-californias-climate-change-preparations.

80. Georgetown Climate Center's Adaptation Clearing House, *California Climate and Energy Profile*, (February 2015) http://www.georgetown climate.org/adaptation/state-information/overview-of-californias-climate-change-preparations.

81. E&ETV, *Climate: U.S. Adaptation Plans Show Varied Success in States* (October 2014), *available at* http://www.eenews.net/tv/videos/1886/transcript.

82. Department of Ecology State of Washington, *Preparing for a Changing Climate: Washington State's Integrated Climate Change Response Strategy* (April 2012), *available at* http://www.ecy.wa.gov/climatechange/ipa_responsestrategy.htm#REPORT.

83. Georgetown Climate Center, *New York Climate and Energy Profile*, (April 2015) http://www.georgetownclimate.org/adaptation/state-information/overview-of-new-yorks-climate-change-preparations.

84. Inside Climate News, *6 of the World's Most Extensive Climate Adaptation Plans*, (June 20, 2013) http://insideclimatenews.org/news/20130620/6-worlds-most-extensive-climate-adaptation-plans. A Stronger More Resilient New York was based on hyper-local climate models specific to New York City. The models come from the IPPC the Fifth Assessment Report, which can project future climate in more detail and on a smaller scale than previous models.

Eight states and the District of Columbia have state-led adaptation plans underway and should have final plans in the near future.[85] However, twenty-seven states have yet to begin state-led adaptation planning, including states with significant vulnerable coastline, such as Texas, North Carolina, and South Carolina. Furthermore, while some states have managed to put plans together, there is no guarantee that these plans are leading to adaptive actions. For example, according to Monica Trauzzi, a reporter for E&E TV, Florida has yet to complete any of the twenty-eight adaptation goals it has put in place.[86]

Local governments have also played a part in the undertaking of adaptation initiatives.[87] However, local actors have a more difficult time overcoming industry opposition. They have a narrow scope of authority and often a limited budget. While some local governments have been trailblazers in this arena, the country still needs bigger picture initiatives.[88]

Given the complex scientific and policy decisions ahead, reducing the United States' vulnerability to future climate impacts will require an unprecedented level of collaboration between federal and state government. This is no easy task. To date, adaptation efforts have been driven by the President and state legislatures.[89] In the absence of a national adaptation mandate from Congress, these plans follow different templates and achieve varying levels of effectiveness. Given the current state of Washington politics, it is unlikely that Congress will pass a new federal adaptation law even though such legislation is badly needed.

85. Georgetown Climate Center, *State and Local Adaptation Plans*, (April 2015) http://www.georgetownclimate.org/adaptation/state-and-local-plans.

86. E&ETV, U.S. *Adaptation Plans Showed Varied Success in States*, (Oct. 22, 2014) *available at* http://www.eenews.net/tv/videos/1886/transcript. Local and regional governments have started taking action even when states are not. For example, Miami-Dade County established a Climate Change Advisory Task Force which has undertaken significant climate adaptation efforts. Miami-Dade County, *Climate Change Advisory Task Force*, (Oct. 21, 2014) *available at* http://www.miamidade.gov/environment/boards/climate-change-task-force.asp.

87. Patricia Salkin, *Can You Hear Me Up There? Giving Voice to Local Communities Imperative for Achieving Sustainability*, ENVIRONMENTAL & ENERGY LAW AND POLICY JOURNAL, Vol. 4, 256, 276 (2009).

88. Local Government Commission, *San Luis Obispo County Climate Change Adaptation*, (2010) *available at* http://www.lgc.org/the-issues/climate-change/slo.

89. Center for Climate and Energy Solutions, *Climate and Energy Action in Congress*, (2015) available at http://www.c2es.org/federal/congress; Georgetown Climate Center, *State and Local Adaptation Plans*, (April 2015) http://www.georgetownclimate.org/adaptation/state-and-local-plans.

Therefore, existing federal laws should be examined for ways in which statutes can be amended or repurposed for adaptation planning. As a recent report from the Center for Progressive Reform states, "[s]ome existing laws simply need better, stronger and more consistent enforcement, whereas others require some reinterpretation or emphasis on overlooked provisions."[90] Looking at existing federal laws suitable for the task of adaptation planning, the CZMA is a promising option.[91]

III. Does the Coastal Zone Management Act Have the Capacity to Spearhead Coastal Adaptation?

Part III begins with a discussion of four principles for effective adaptation, followed by an introduction to the CZMA. The section then analyzes the ways in which the CZMA currently meets the core adaptation principles, the ways in which it falls short, and how it may be repurposed or amended to meet these central tenets.

A. The Four Principles for an Effective Adaptation Plan

Effective adaptation planning should have four characteristics. First, plans should have clear, specific, and balanced goals that include measurable criteria and principled flexibility. Second, they should have an enforcement system that ensures thoughtful planning is turned into action. Third, they should detail a system of intergovernmental cooperation in which the federal government articulates the overarching regulatory system, delegates implementation of the programs to states, and provides technical assistance and funding to these state programs. Fourth, plans should provide broad participation across stakeholders throughout the regulatory process, and include substantive measures to encourage equitable adaptation.

1. Goals

Goals should include actions that explain how measures will be implemented to achieve substantive objectives, as well as measurable criteria that allow regulators to assess which goals they have achieved and which need more work. Adaptation goals should be articulated by the federal government and implemented by the states. They should also incorporate features of principled flexibility to encourage decision makers to move forward in the face of scientific uncertainty and adjust adaptive actions as new information and circumstances emerge.

90. Center for Progressive Reform, *supra* note 44 at 18.

91. Coastal States Organization, *The Role of Coastal Zone Management Programs in Adaptation in Climate Change*, (September 2008).

a. Clear, Specific, and Balanced

The federal government should draft adaptation plans that provide states with a list of clear and specific goals.[92] Such a list gives the states succinct directions on what they need to accomplish. Precise goals also leave states with little room to reinterpret objectives. Vague goals can be used by states to avoid tough decisions; under the umbrella of a broad statement, states can adopt weak measures that avoid disrupting the status quo. Many of the regulatory actions necessary for effective adaptation, such as no build zones, relocation, or expensive fortification projects, will be met with strong opposition.[93] States therefore need direction as well as pressure from the federal government to conduct this type of planning.

The federal government should maintain a balance of objectives among the list of goals. Adaptation plans should safeguard economic development, preserve and restore ecological recourses, and ensure public safety. By providing a list of goals that give these three spheres equal attention, the federal government can limit the possibility that a state is focusing on one topic, like safeguarding economic development, while others, such as ecological preservation, go ignored.[94]

92. Ann Siders, Managed Coastal Retreat Handbook, Columbia Center for Climate Change Law, 29 (October 2013) [hereinafter Siders], *available at* https://web.law.columbia.edu/sites/default/files/microsites/climate-change/files/Publications/Fellows/ManagedCoastalRetreat_FINAL_Oct%2030.pdf; Philip R. Berke and Steven P. French, *The Influence of State Planning Mandates on Local Plan Quality*, 13 JOURNAL OF PLANNING EDUCATION AND RESEARCH, 237, 247 (1994).

93. *See* Bryne and Grannis, *supra* note 19 at 268 (describing the difficult social and economic tradeoffs that governments have to face when implementing adaptation measures); *See also* Tim Eichenberg, *The Challenges of Adapting to Climate Change In San Francisco Bay*, 19 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 393, 402 (2013), (describing how "development and business interests spent nearly $500,000 lobbying against . . . proposed climate policies" in San Francisco Bay.)

94. Center for Progressive Reform, *supra* note 44 at 17, (describing the importance of incorporating green infrastructure into climate adaptation strategy); National Climate Assessment, *Coastal Impacts, Adaptation, and Vulnerabilities*, 1, 113 (2013), http://www.southernclimate.org/documents/Coastal_Technical_Input_2012.pdf (describing how restoration of coastal ecosystems can provide mutual societal, ecological, and financial co-benefits.)

b. Actions and Measurable Criteria

Goals should include actions that explain how the measures will be implemented, as well as performance metrics by which state progress can be monitored. Measurable criteria will make certain that a state does not just have a plan, but that it is turning that plan into action. The criteria will allow the federal government to identify which states are failing to effectuate adequate programs or a specific area where a state is struggling. A uniform system of comparison is important for enforcement purposes and helps the federal government ensure that a somewhat uniform level of climate preparedness is occurring across the nation.

c. Principled Flexibility

Lastly, adaptation planning involves decision-making in the face of scientific uncertainty. By incorporating features of principled flexibility into the goals of an adaptation plan, regulators can begin acting while still leaving room for adjustment once information becomes available.[95] Adaptation plans can incorporate scenario-based planning that accounts for scientific uncertainty by modeling the likelihood of a given impact.[96] Regulators can use worst-case scenario models in order to visualize potential future impacts, then design plans and implement defenses based on those projections. Similarly, by using adaptive management techniques, regulators can design management actions as scientific experiments in which they monitor outcomes and adjust their regulations according to the information produced by these experiments.[97] These techniques allow regulators to incorporate important feedback and scientific updates. In the absence of the relevant science, regulators can still move ahead—instead of sitting by, waiting for climate science to advance.

2. Enforcement

Adaptation plans are only effective if properly enforced. Enforcement means ensuring plans meet certain requirements and these requirements are translated into action. While enforcement measures can take different forms, those that are coercive have the greatest compliance.[98]

95. Verchick and Scheraga, *supra* note 28 at 238.

96. Leigh Welling, A *Tool for Decision-Making in an Era of Uncertainty*, National Park Service Climate Change Response Program, (December 2010) http://www.nps.gov/news/upload/Scenario-planning-brief-Jun2011.pdf.

97. Center for Progressive Reform, *supra* note 44 at 23.

98. Siders, *supra note* 92 at 29; *See also* J. Scholz, *Cooperation, Deterrence, and the Ecology of Regulatory Enforcement*, 18 LAW & SOC'Y REV. 179 (1984). [hereinafter Scholz.]

Adaptation plans need to include an approval process that conditions authority or funding upon a showing that certain goals or criteria have been met. This ensures plans are well thought out both procedurally and substantively. An approval process can also be a means by which the approving body helps guide the shape and content of a plan.

Ensuring that a plan is comprehensive is not enough; adaptation policies must also contain enforcement measures that hold decision makers accountable to actions.[99] Coercive enforcement, or measures that tie punishments to noncompliance, are more effective than permissive mandates.[100] For example, plans could set benchmarks or thresholds that, if reached, require a certain course of action. Funding could be revoked if certain plans are not adhered to.[101] Climate change poses serious risks, and failing to undertake appropriate adaptation planning should have serious consequences.

3. Coordinated Governance

Climate impacts will extend beyond state lines and the measures that are needed to address them will be outside individual state control. Climate adaptation requires big picture planning and thoughtful delegation.[102] An ideal regulatory system would be one by which the federal government articulates the overarching plan and control mechanisms, and then delegates implementation to the states. In addition to coordinating efforts, the federal government will play a vital support function, ensuring states have sufficient scientific information and funding to run adaptation programs.

a. Inter-governmental Cooperation

There are a host of environmental laws and agencies that could be used to address climate change in the United States.[103] The federal government should set the direction of an adaptation plan so that decision makers are on

99. Holly Doremus et al., *Making Good Use of Adaptive Management*, CPR White Paper Pub. No. 1104, 11 (April 2011), *available at* http://www.pro gressi vereform.org/articles/Adaptive_Management_1104.pdf [hereinafter Doremus].

100. Siders, *supra* note 92 at 29.

101. Center for Progressive Reform, *supra* note 44 at 22.

102. *See e.g.* Robin Kundis Craig, *"Stationarity is Dead"—Long Live Transformation: Five Principals for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 53 (2010) (discussing how planning for future climate change adaptation will become increasingly important at all levels of government).

103. Verchick and Scheraga, *supra* note 28 at 241-255 (describing a number of federal, state, and local laws that are used in coastal management.)

the same page about what agencies, laws, and programs are in use. By flushing out their adaptation plans underneath a federal umbrella, states can avoid developing regulatory schemes that conflict with one another.[104]

b. Information Sharing

The federal government should help develop and disseminate scientific information to the states. States have specialized knowledge of local conditions, culture, and preferences, but they lack access to the most up-to-date climate science and tools for assessing short and long-term impacts.[105] Furthermore, state planners face information overload when they look at the numerous reports, tools, and climate change data available.[106] The federal government should not only cultivate, but also sift through this information, so that local decision makers can more easily determine the risks to their communities and the range of responsive measures available to them.[107]

There are also patterns in climate impacts that enable an exchange of regulatory models and best practices.[108] Each community will have its own

104. See California Natural Resources Agency, *California Climate Adaptation Strategy*, 1, 22 (2009) http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf (discussing how policy coordination is necessary to avoid duplicative efforts that waste money and create confusion.)

105. J.A. Ekstrom and S.C. Moser, *Identifying and Overcoming Barriers in Urban Adaptation Efforts to Climate Change: Case Findings From the San Francisco Bay Area, California*, USA, URBAN CLIMATE 9, 54, 61 (September 2014), *available at* http://dx.doi.org/10.1016/j.uclim.2014.06.002 (finding a failure to understand climate science is a common barrier for state actors who are implementing adaptation measures.)

106. In 2007 the Coastal State Organization Climate Change Work Group published a report entitled *The Role of Coastal Zone Management Programs in Adaptation to Climate Change* that called for "a single source for the most up-to-date sea level rise and climate projections. Since that time, NOAA has developed Climate.gov, which is designed to be "a source of timely and authoritative scientific data and information about climate." This is exactly the kind of single-inventory of climate change science that is needed from the federal government and efforts should continue to be made to tailor this resource to state government needs.

107. Georgetown Climate Center, *Preparing for Climate Impacts: Lessons Learned From the Front Lines*, (July 9, 2014) [hereinafter Lessons Learned from the Front Lines], *available at* http://www.georgetownclimate.org/preparing-for-climate-impacts-lessons-learned-from-the-front-lines.

108. Lessons Learned from the Front Lines, *supra* note 107 at 7 (noting that every community has unique vulnerabilities but whenever possible policymakers should exchange information where their needs align.)

vulnerabilities but there will also be a body of shared experience as people along the coast face the same challenges. The federal government should formulate planning guides to help states recognize where their needs align and what regulatory measures have been successful in similar situations. This will help streamline adaptation planning as states learn from each other's triumphs and avoid repeating each other's mistakes.

c. Funding

The federal government should also provide consistent and dedicated funding. Formulating and running adaptation plans will be costly but the regulatory actions these plans put in place will push the budget into the billions.

Moving or fortifying key infrastructure such as roads, airports, and sewage treatments plants will cost billions.[109] So will compensating property owners in high-risk locations.[110] Disaster preparedness and recovery, as evidenced by the $108-billion price tag for Hurricane Katrina[111] and $50 billion price tag for Hurricane Sandy,[112] will also be astronomically expensive.[113]

State governments will not be able to shoulder this financial burden on their own. Financing disaster recovery or other measures may also siphon funding from other important state programs like education. Lastly, adaptive management requires more resources than conventional management strategies; more technical and scientific resources are needed to monitor climate change, and greater personnel resources are needed to implement and amend actions based on these results.[114]

109. The World Bank, *Economics of Adaptation to Climate Change*, (June 6, 2011) (The Economics of Adaptation to Climate Change Study finds that "the cost between 2010 and 2050 of adapting to an approximately 2°C world by 2050 is in the range of $70 billion to $100 billion a year.")

110. Byrne and Grannis, *supra* note 19 at 269 (recognizing that land needed for retreat is often already developed and in use making it expensive for the government to acquire.)

111. *See* Knabb, *supra* note 20.

112. Huffington Post, *Hurricane Sandy was the Second-Costliest in* U.S. *History, Reports Show*, (Feb. 12, 2013) http://www.huffingtonpost.com/2013/02/12/hurricane-sandy-second-costliest_n_2669686.html.

113. *Id.* These numbers reflect the total damages not the price of preparedness or recovery but nevertheless serve as proxies for what super storms cost a state government.

114. Doremus, *supra* note 99 at 5 (explaining that adaptive management requires more resources then conventional management strategies and is therefore more expensive.)

The federal government needs to allocate a significant pool of money to finance state-run adaptation programs. Dedicating sufficient funding sends a clear message that climate change preparedness is a national priority and in turn makes it easier for states to "enact regulations—the stick—if there is the promise of federal funding—the carrot."[115]

4. Participation and Fairness

The final elements for effective adaptation are participation and fairness. First, plans need to include procedural mechanisms that enable broad participation throughout the regulatory process. Adaptation requires value-laden choices that will put the needs of some before others.[116] Broad participation from all stakeholders is necessary to make sure these decisions are well informed and fair. Second, plans must include provisions that ensure substantive outcomes are equitable. Climate change will disproportionately impact socially isolated and politically disadvantaged communities.[117] Government plans must therefore require decision makers to account for inequality and vulnerability when adopting regulatory actions.

a. Broad Participation

Adaptation plans must put in place processes that ensure broad participation from all citizens throughout regulatory development. Plans should provide for bottom-up participatory mechanisms that transfer community-specific information to decision makers. Only local actors will know the history, politics, and culture that inform the decisions of a specific region.[118] While decision makers will reside with more centralized and removed levels of government, this particularized knowledge must still be transmitted to the top and used in regulatory planning.

Local hearings can help facilitate this type of information gathering. They also provide an opportunity for smaller or more marginalized players to voice their opinions. An important feature considering value-laden choices

115. Lessons Learned From the Front Lines, *supra* note 107 at 9.

116. Sean Hecht, *Local Governments Feel the Heat: Principles for Local Government Adaptation to the Impacts of Climate Change*, 47 J. MARSHALL L. REV. 635 (2013) [hereinafter Hecht.]

117. Carolina Hillemanns, UN *Norms on the Responsibilities of Transnational Corporations and Other Business Enterprises with Regard to Human Rights*, GER. L.J. Vol. 4, 10 1065, 1075 (2003) [hereinafter Hillemanns.]

118. Hecht, *supra* note 116 at 635 (explaining that "because local governments bear direct responsibility for much of the public safety, land-use planning, infrastructure, emergency response, and public health protection programs upon which all of us rely, they will be at the front lines of addressing climate change impacts.)

are an inevitable component of adaptation.[119] Communities will have to make difficult decisions about investment priorities, like whether it is more important to protect ecosystems or infrastructure, or whether the best protection should be given to the most valuable resources or those that are the most vulnerable.[120] Furthermore, regulatory decisions may mean certain communities, and, therefore, individuals, receive better protection than others. When making these decisions, it is vital that underrepresented populations, and not just strong interest groups, have a say.[121]

Finally, plans should provide opportunities for public input throughout the decision making process. A public hearing for a completed plan is not a real opportunity for participation. Furthermore, a planning process that leaves input opportunities until the end is lacking in the wealth of knowledge that local actors may be able to contribute.[122] Public hearings should therefore be held at the start of a plan, at the local level, with targeted outreach, and with follow up hearings throughout the regulatory process.

b. Fairness

Regulators should contemplate whether a regulatory decision produces equitable outcomes for all members of society. The government will have to mandate consideration of disadvantaged communities because, in many instances, these communities lack the knowledge and means to protect themselves and the political power to make their needs heard.

To quote Robert R.M. Verchick: "although disasters appear to be 'social equalizers that are blind to race, creed, and color, long-term recovery efforts are nearly always accompanied by patterns of unfair social distribution."[123]

119. Alice Kaswan, *Seven Principles for Equitable Adaptation*, 13 Sustainable Development Law and Policy 41, 45 (2013) [hereinafter Kaswan, *Seven Principles for Equitable Adaptation*]; *see also* J.B. Ruhl, Climate Adaptation and the Structural Transformation of Environmental Law, 40 ENVT. L. 363 (2010) [hereinafter Ruhl].

120. Susan L. Cutter et al., *Social Vulnerability to Climate Variability Hazards: A Review of the Literature*, Hazards and Vulnerability Research Institute (2009), *available at* https://forestadaptation.wikispaces.com/file/view/Oxfam_Vuln_Literature_Review.pdf.

121. Kaswan, *Seven Principles for Equitable Adaptation*, *supra* note 119 at 45 (explaining that "While good participatory mechanisms cannot erase endemic power imbalances, they at least provide transparent forums that give historically less powerful constituents a seat at the table.")

122. Hecht, *supra* note 116 at 635.

123. Robert R.M. Verchick, *Facing Catastrophe: Environmental Action for a Post-Katrina World*, Harvard Univ. Press 2010.

Like natural disasters, other climate change impacts, such as heat waves and flooding, will disproportionately impact the poor, sick, and elderly, as well as immigrants, minorities, and other socially isolated and politically disadvantaged communities.[124]

Government action is needed to address this systematic disparity. In many instances the disadvantaged lack the knowledge to protect themselves from climate change, but, even with sufficient warning, they may still lack the means to act.[125] Poor communities are less equipped to prepare, insure, or move.[126] They are also attracted to housing that becomes affordable because it has been designated as at risk.[127] Because market forces make disadvantaged communities more susceptible to climate impacts, adaptation plans need to put in place government actions and programs that will provide the disadvantaged with better protection.

Adaptation plans should conduct risk assessments that evaluate the likelihood that a climate impact will affect a community.[128] These risk assessments should take into consideration not just physical characteristics, like the price of land, but also social demographics such as the age, race, and average income. Adaptation plans should require states to prioritize protection of communities most vulnerable to climate change and least equipped to cope—not just those communities with the most infrastructure or the most valuable land.[129]

The following section begins the discussion of the CZMA's viability as an adaptation plan, beginning with a background of the Act.

124. *See* Hillemanns, *supra* note 117.

125. Rhul, *supra* note 119 at 406 (discussing inequality in the distribution of climate adaptation resources.)

126. Maxine Burkett, *Just Solutions to Climate Change*: A *Climate Justice Proposal for a Domestic Clean Development Mechanism*, 56 BUFF. L. REV. 169, 176-188 (2008).

127. *Id*.

128. Hecht, *supra* note 116 at 636-640.

129. Kaswan, *Seven Principles for Equitable Adaptation*, *supra* note 119 at 42. Equitable adaptation is not only beneficial for the marginalized, it benefits society at large. Homelessness, unemployment, illness, and economic hardship are consequences of environmental degradation and disaster that create social instability. To quote Professor Alice Kaswan: "Considered comprehensively, it is more prudent to develop adaptation plans that avoid harm than it is to attempt to repair the harm after the fact—or suffer the consequence of irreparable devastation."

B. Overview of the Coastal Zone Management Act

The CZMA was enacted in 1972 to "preserve, protect, develop, and where possible, to restore and enhance, the resources of the Nation's coastal zone for this and succeeding generations."[130] Congress passed the statute in response to growing public concern over the degradation of the United States coastline due to pollution, development, and ecological destruction.[131]

The CZMA established two national programs: the National Coastal Zone Management Program, which is the focus of this paper, and the National Estuarine Research Reserve System.[132] The National Coastal Zone Management Program is designed to balance "the often competing and occasionally conflicting demands of coastal resource use, economic development, and conservation."[133] The overarching objectives of the program are to: protect natural resources; manage development in high hazard areas; give development priority to coastal-dependent uses; prioritize water-dependent use; improve public access; and coordinate state and federal actions within the coastal zone.[134]

The program establishes a voluntary partnership between the federal government and coastal and Great Lake states to address national coastal issues. Congress rejected a mandatory approach for the CZMA and instead offered the states the dual incentives of federal consistency and federal funding to compel, rather than require, states to carry out national objectives through state regulations and programs.[135]

130. 16 U.S.C. § 1452(2)

131. Robert Bailey and Kristen Fletcher, F*orty Years of the* C*oastal Zone* M*anagement* A*ct*: I*mpacts and* I*nnovations*, Coastal Management Vol. 41, 193 (2013) [hereinafter Bailey and Fletcher.]

132. S*ee* 16 U.S.C. § 1456-1, authorizing the Secretary to conduct a Coastal and Estuarine Land Conservation Program, in cooperation with state and local government, for the purposes of protecting important coastal estuarine areas that have significant ecological, aesthetic, or cultural value.

133. 16 U.S.C. § 1452(1)-(6).

134. I*d*.

135. Bailey and Fletcher, *supra* note 131 at 194. Federal consistency requires federal actions within the coastal zone to be consistent with a state's federally approved coastal management program. Federal actions include federal agency activities, federal license or permit activities, and activities that are federally financed. Altogether, the consistency provision is a major incentive for states to develop a coastal management program that gives states influence over federal activities in its coastline that it would not otherwise have.

In order to participate in the national program, a state must develop a management program that addresses: coastal development; water quality; public access; habitat protection; energy facility siting; ocean governance and planning; and coastal hazards.[136] In addition to substantive requirements, a state management program must also meet certain procedural elements.[137] State plans need to identify the means, i.e. laws and regulations, under which the state proposes to exercise control over coastal land and water uses.[138] They need to include broad guidelines for identifying priorities of uses in particular areas.[139] And, states must provide a description of the organizational structure that will implement the program, including the responsibilities and interrelationships of local governments in the management process.[140]

The federal government, through NOAA, approves state programs to determine if they meet the national goals.[141] If approved by the Secretary, the federal government provides the state with financial and technical assistance. The federal government has designated a specific "Coastal Zone Management Fund." This fund is for: state management programs; emergency grants for state coastal zone management agencies that have experienced unforeseen disaster; appropriate awards recognizing excellence in coastal zone management; and states investigating and applying the public trust doctrine to implement their programs.[142]

In addition, the Secretary conducts technical assistance and management-oriented research to support approved state management programs. Under this provision of the CZMA, any agency or instrumentality of the Federal government can help NOAA coordinate research and make the results of studies available to the states by furnishing information or transferring personnel.[143] The Secretary is also obligated to consult with coastal states on a regular basis regarding their program's needs.[144]

The Secretary reviews the performance of costal state management programs and may suspend portions of funding or withdraw approval of a management program if a state is failing to adhere to the management program, any portion of a plan or program, or any terms of a grant.[145] In

136. 16 U.S.C. § 1452(1)-(6); 16 U.S.C. § 1455.
137. 16 U.S.C. § 1455(2)(D).
138. *Id*.
139. 16 U.S.C. § 1455(2)(E).
140. 16 U.S.C. § 1455(2)(F).
141. 16 U.S.C. § 1454-1455.
142. 16 U.S.C. § 1456(b).
143. 16 U.S.C. § 1456(c).
144. 16 U.S.C. § 1456(c)(3).
145. 16 U.S.C. § 1458.

addition, the Secretary must report every two years to Congress and the President, summarizing the state of the national program.[146] The report must include a description of state programs and their accomplishments; an itemization of the allocation of funds; a breakdown of the major areas where funding was spent within states; a summary of coordinated national strategy; a summary of outstanding problems arising in the administration of the CZMA; a summary and evaluation of the research and training conducted to support coastal management; and recommendations for additional legislation to improve the national program.[147]

The CZMA contains several special provisions. The first is the Coastal Resource Improvement Program that provides federal grant money to state programs that preserve or restore coastal areas with ecological, aesthetic, or historical significance.[148] The second is the Coastal Nonpoint Pollution Control Program that gives money to state programs that restore and protect coastal waters.[149] The third is the Coastal Zone Enhancement Grants program, through which the federal government can award funds to states whose management programs support certain coastal zone enhancement objectives, including: preventing threats to life and destruction of property by eliminating development and redevelopment in high-hazard areas or anticipating the effects of potential sea level rise; developing procedures that consider and control secondary effects of development on resources, like wetlands; and preparing special area management plans for important coastal areas.[150]

Finally, the CZMA provides for federal consistency. States with federally approved coastal management programs have the authority to review federal permits and activities to ensure that they are consistent with state coastal programs.[151] Altogether, this "reverse preemption" has helped create a culture of coordination between the state and federal governments.[152]

146. 16 U.S.C. § 1462.

147. 16 U.S.C. § 1462(a)-(b).

148. 16 U.S.C. § 1455(a).

149. 16 U.S.C. § 1455(b).

150. 16 U.S.C. § 1456(b).

151. 16 U.S.C. § 1456.

152. Bailey and Fletcher, *supra* note 131 at 194. However, the CZMA contains a "national interest" provision that allows the federal government to bypass federal consistency considerations when the federal activity is deemed by the Secretary of Commerce to be in the "national interest." This loophole has been used by the federal government to pursue offshore oil and gas development unconcerned with consistency requirements with state Coastal

Overall, the CZMA has been recognized for its flexibility, which "enables states and territories with diverse geographies, cultures, and political administrative regimes to successfully implement coastal management programs."[153] By vesting the primary role of management with the state, some argue the CZMA has made it possible for communities with a variety of circumstances to develop management programs that meet their unique set of conditions and needs.[154]

The CZMA is a promising piece of existing legislation that could be repurposed or amended to help states enact climate change adaptation plans within or in addition to coastal management plans. The CZMA already takes into consideration a number of the preservation, restoration, and development objectives that are pertinent to climate preparedness.[155] The CZMA includes some enforcement and review provisions to ensure compliance.[156] It provides a predetermined system of intergovernmental cooperation that could speed up implementation of adaptation plans.[157] And, the CZMA provides, to some extent, democratic participation and fairness.[158] While the CZMA is not perfect it is a statutory foothold that could mainstream adaptation planning.

C. Does the Coastal Zone Management Act Meet the Four Principles of an Effective Adaptation Plan? Could it be Amended to Meet Them?

The following section will analyze the ways in which the CZMA meets the four principles for effective adaptation. After reviewing the ways in which it meets or fails to encompass these tenets, amendments are proposed that would improve the CZMA's capacity to generate necessary adaptation planning.

1. The Goals of the Coastal Zone Management Act

The goals of the CZMA need major revising if it is to be used towards effective adaptation planning. Altogether, the existing goals are overly vague, leaving too much room for state discretion. The goals need to be rewritten

Management Plans—exceptions like these have been the subject of much debate. 16 U.S.C. § 1456((3)(A); McGuire, *supra* note 16 at 16-19.

153. Bailey and Fletcher, *supra* note 131 at 193.

154. Bailey and Fletcher, *supra* note 131 at 193.

155. 16 U.S.C. § 1452(1)-(6).

156. 16 U.S.C. § 1454-1455; 16 U.S.C. § 1458.

157. 16 U.S.C. § 1455(2)(F); 16 U.S.C. § 1456.

158. 16 U.S.C. § 1455(1).

with greater clarity, specificity, and an order of priority. They also need to include actions, measurable objectives, and features of principled flexibility.

a. Clear, Specific, and Balanced

The overarching purpose of the CZMA is to "preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations."[159] The CZMA encourages, but does not require, coastal and Great Lake states to develop management programs that address national coastal issues.[160] These management programs are expected to "at least provide" for a series of substantive and procedural goals.[161] These goals require states to formulate plans that address coastal development, coastal hazards, habitat protection and restoration, water pollution, and public access to coastal waters.[162]

While these goals are formulated for coastal management programs, they are equally relevant considerations for an adaptation plan. However, for adaptation purposes, the goals of the CZMA are overly broad, leaving too much to state discretion.

The goals of the CZMA were designed by Congress to be flexible. Congress felt a framework was important so states could create and adopt programs that would meet their unique set of political, legal, and cultural conditions.[163] Leaving room for states to tailor plans to local needs is important, but goals that are too general present a number of difficulties.

For example, one goal under the CZMA requires states to "provide for the protection of natural resources including wetlands . . . beaches . . . etc."[164] This goal provides no instruction to states about how sea level rise should be taken into account in determining how coastal wetlands and beaches should be protected. States have to spend time and money formulating measures for resource protection and may have little insight on whether the policies they put in place are effective. There is also no information on what constitutes protection. Do states need to adopt no-build zones? Do they need to erect sea walls? Do they need to actively restore beaches and wetlands? Without goals that provide clear guidelines there is no way of knowing.

In amending the goals, the federal government could require consideration of a base rate of sea level rise in the siting, design, and

159. 16 U.S.C. § 1452.

160. 16 U.S.C. § 1452(2).

161. *Id.*

162. 16 U.S.C. § 1452(A)-(K).

163. Bailey and Fletcher, *supra* note 131 at 193.

164. 16 U.S.C. § 1452(A).

implementation of any building project within 100 feet of the shoreline.[165] This sort of goal moves within the federal mandate that states take sea level rise into account, yet still leaves room for states to plug in projections suitable for their area.

The federal government could draft a goal that requires states to conduct vulnerability assessments based on factors such as the quality of the housing stock, land elevation, proximity to other hazards, a community's financial recourses, access to health care, and geographic mobility. Rather than simply telling states they need to conduct vulnerability assessments, the CZMA should specify what factors, both physical and social, should be taken into consideration when identifying those populations most vulnerable to climate impacts.

The Act could also include a goal that a certain percent of CZMA funding be put towards ecological preservation such as beach nourishment or wetland restoration. This would ensure states are considering soft as well as hard armoring measures.[166] In addition, states would have the dual benefit of preventing coastal erosion while restoring habitat and protecting ecosystems.

Under the current CZMA it is up to the states to decide what actions, if any, they will take to address climate change.[167] This is indeed problematic. While the federal government may want to consider a host of substantive goals, whatever is included in the final list needs to give states firm and concise direction in order to start adaptation planning.

Also, under the current CZMA, states have discretion to balance environmental concerns and development objectives as they see fit.[168] Effective adaptation protects public safety, ensures resource preservation, and safeguards economic development. The revised federal goals should prioritize each of these three interests equally. Failing to do so opens up the possibility of a state focusing only on one objective while other provisions are ignored.

b. Actions and Measurable Criteria

The goals of the CZMA need to be amended to include measurable criteria. The CZMA has been praised for helping states enact comprehensive

165. The State of Rhode Island, *Coastal Resource Management Program*, (December 2012), *available at* www.crmc.ri.gov/regulations.html. Rhode Island adopted a coastal policy that calls for an accommodation of a "base rate of expected three- to five-foot rise in sea level by 2100 in the siting, design and implementation of public and private coastal activities."

166. Verchick and Sheraga, *supra* note 28 at 239.

167. 16 U.S.C. § 1452.

168. *Id*.

coastal management policies.[169] Once in place, however, there are few parameters that ensure that states are translating these plans into actions, or that after a few years—or even months—plans are still being adhered to. In order to monitor state progress, the goals of the CZMA need to be tied to performance metrics.

Recently, OCRM established the Coastal Zone Management Performance Measurement System and the National CZM Program.[170] The National CZM Program established national performance goals for five categories; public access; coastal community development; coastal habitat; and coordination and public involvement.[171] Specific performance measures were developed to help assess how well states are meeting the five goals.[172] For example, the performance measure for public access is the number of public access sites created and enhanced.[173]

This program is a step in the right direction but a lot more could be done. Rather than developing a separate measurement system, quantitative benchmarks should be written into the goals themselves. For example, instead of requiring state management programs to protect natural resources such as beaches, the CZMA could mandate that by 2020 state management programs must designate no-build provisions within 100 feet of the mean high tide line. By setting a deadline and providing a clear, specific, and measurable objective, the federal government can be sure states are achieving a minimum level of adaptation. The federal government can also monitor state progress and either assist or discipline states that are failing to meet these objectives.

c. Principled Flexibility

Principled flexibility needs to be written into the goals if the CZMA is going to be repurposed for adaptation plans and not solely coastal management. For example, the goal for beach preservation could hold that by 2020 state management programs, using the best available sea level rise

169. Bailey and Fletcher, *supra* note 131 at 193. (explaining how "the CZMA has emerged as central to the ability of the nation to manage its coastal resources. There is arguably no more important federal legislation for ensuring that the nation's priceless ocean and Great Lake coasts are protected and enjoyed.")

170. NOAA, *Coastal Zone Act Performance Measurement System*, *Coastal Management Program Guidance* (April 2011) http://coastalmanagement.noaa.gov/backmatter/media/czmapmsguide11.pdf.

171. *Id.*

172. *Id.*

173. *Id.*

projections, must designate no-build provisions within 100 feet of the mean high tide line. Adaptation decisions need to be based in the best available climate data but the requisite information for a particular decision may not always be available or may be subject to change.[174] When trying to set a building ordinance like the one above, decision makers need localized sea level rise projections. These models may not yet be in existence or those available may provide only loose predictions.[175] Nevertheless, scientific uncertainty cannot be an excuse to do nothing.[176] Rewriting the goals to include principled flexibility forces regulators to take action but still gives them room to adjust their policies once new science becomes available.

d. The Federalism Implications of a Stronger Federal Role in Goal-Setting under the Coastal Zone Management Act

It is important to pause here and discuss why adaptation requires a stronger federal role. Part of adaptation planning is determining what governance structure will lead to the most effective policies. Professor Alice Kaswan refers to this concept as "pragmatic efficacy"; a component of federalism that addresses "what jurisdictional levels have the requisite motivation and regulatory capacity and, accordingly, on what distribution of authority will provide the best regulation, both in substance and degree."[177]

This conversation involves a debate between those who favor local control and those who support a more centralized model.[178] This paper calls for increased federal oversight but recognizes the need for multilevel governance in which specific federal goals are coupled with state and local planning.

At first look, local governments appear to be the ideal actor to formulate adaptation plans. Local communities are the ones who bear the brunt of flood, fire, erosion, storm surge, infrastructure collapse, and other climate

174. Hecht, *supra* note 116 at 640.

175. Craig, *supra* note 102 at 39.

176. Hecht, *supra* note 116 at 641.

177. Alice Kaswan, *Climate Adaptation and Land Use Governance: The Vertical Axis*, COLUM. ENVTL. L. VOL. 39 (2014) [hereinafter Kaswan, *Climate Adaptation and Land Use Governance*].

178. Kristen H. Engel, *Harnessing the Benefits of Dynamic Federalism in Environmental Law*, 56 EMORY L.J. 159, 163-165. More recently scholars have been rejecting arguments favoring exclusive federal or local control of an environmental issue in favor of Dynamic Federalism, a theory in which federal and state governments function as alternative centers of power with deliberately overlapping jurisdictions. Ruhl, *supra* note 119 at 424.

impacts. Local actors are at the frontlines of change and these changes manifest themselves differently in each region.[179]

Local governments have better on-the-ground knowledge of the impacts as well as the positive and negative consequences of the measures used to address them. In addition, proponents of local control argue that only local officials are prepared to tailor adaptation plans to their jurisdictions' environmental and socioeconomic needs.[180] A federal adaptation plan would offer a single monolithic approach that poses some risk. A national policy may become stagnate whereas local policies can serve as laboratories for democracy. Nimble, local decision makers can experiment with different policies, allowing others to learn from their success and failures. Under a single federal approach, there are national, opposed to only regional, repercussions if a plan turns out to be misguided.[181]

Despite its strengths, exclusive local control over adaptation planning is problematic.[182] For starters, states are susceptible to a "race-to-the-bottom." For example, a state may need to mandate a no-build zone in a flood prone area to protect development from sea level rise or storm surge. However, if a state fears that enacting this mandate will drive away business to a less restrictive jurisdiction, a less effective but more business friendly measure may be adopted. States can become engaged in a downward spiral, in which each one strives to have the least restrictive environmental regulations in order to attract business that will provide jobs and taxable income.

Free-riding is also a concern. Some states may hope to benefit from neighboring adaptation plans and therefore fail to invest in their own regulatory programs. On the flip side, some states may suffer from a neighboring jurisdiction's decision to act. For example, if one community

179. "The case for local and regional governance in adaptation policy is strengthened by the variations in climate change impacts across the landscape. Adaptation for Florida, where sea level rise is the primary threat, will not be what it is for Nevada, where even less water is the likely scenario." Ruhl, *supra* note 119 at 423.

180. Henry N. Butler & Jonathan R. Macey, *Externalities and the Matching Principle: The Case for Reallocating Environmental Regulatory Authority*, 14 YALE. L. & POL'Y REV. 23, 25 (1996) (suggesting a "matching principle" according to which "the size of the geographic area affected by a specific pollution source would determine the appropriate governmental level for responding to the pollution" i.e., impacts felt locally should be dealt with by local government.)

181. Kaswan, *Climate Adaptation and Land Use Governance*, *supra* note 177 at 26.

182. Kristen H. Engel, *Harnessing the Benefits of Dynamic Federalism in Environmental Law*, 56 EMORY L.J. 159 (2006).

erects a sea wall, erosion in neighboring areas may increase, as tides and ocean-born storms are directed elsewhere. One state's decision to act or not to act may have negative externalities for surrounding states.[183] Furthermore, many climate impacts are not in fact local but extend beyond the boundaries of regional authority—necessitating management from government with a larger jurisdictional reach.[184]

Finally, climate change considerations should be mainstreamed as much as possible so that adaptation planning becomes a part of all regulatory and business decisions. An adaptation mandate that comes from the federal government is more likely to mainstream climate considerations. A federal directive can trickle down into the policy decisions of state and local actors.

Recognizing the numerous issues at the state level, a strong federal role in adaptation planning is justified. However, the choice does not have to be between federal or local control exclusively. To quote J.B. Rhul, "Attempting to resolve this tension to find just the right scale of governance for adaptation would be a futile undertaking—adaptation policy must operate at all scales in an interconnected network of decision making."[185]

A strong plan will provide for multilevel governance that coordinates and engages local, state, and federal actors. Under this layered system, the federal government establishes planning requirements, in the form of measurable goals that provide the contours of an adaptation plan. It is then up to the state or local government to fill in more specific criteria using their superior local knowledge.

At present, states have primary authority under the CZMA.[186] The federal government, through NOAA, reviews and approves state programs to determine whether they meet national goals.[187] However, because these goals are vague, the real planning and implementation decisions are left up to the state. Some states, like California, New York, and Massachusetts, have been actively addressing adaptation, but others have not.[188]

183. Verchick and Shegara, *supra* note 28 at 241.

184. Daniel A. Farber, *Climate Adaptation and Federalism: Mapping the Issues*, 1 SAN DIEGO J. CLIMATE AND ENERGY L. 259, 266; Robert L. Glicksman, *Climate Change Adaptation: A Collective Action Perspective on Federalism Considerations*, 40 ENVTL. L. 1159, 1184 (2010).

185. Rhul, *supra* note 119 at 424.

186. 16 U.S.C. § 1452; *See also* Ronald R. Rychlak, *Coastal Zone Management and the Search for Intergration*, 40 DEPAUL L. REV. 981, 987 (1991) [discussing how primary authority under the CZMA is most suitable at the state level.]

187. 16 U.S.C. § 1458.

188. Georgetown Climate Center, *Find Out Which U.S. State Are Making Progress in Preparing for Climate Change*, (November 2014) http://www.georgetownclimate.org/find-out-which-us-states-are-making-progress-inpreparing-for-climate-change.

The federal government needs to be sure every state is planning for adaptation and making progress towards achieving climate change readiness. The federal government can set this regulatory floor by providing more specific and measurable goals under the CZMA.

To ensure that states are achieving a certain minimum of adaptation planning, Congress should also amend the CZMA so that the development of state coastal management plans is mandatory rather than voluntary. Free-riding concerns are most significant when some states choose not to participate in coastal management and adaptation planning altogether.

In 2011, Alaska did away with its management plan after a ballot initiative was passed in which the state decided to favor development of its oil and gas industries, unobstructed by the bureaucratic red tape of its Coastal Management Plans' limits on resource development.[189] Alaska has more coastline than the other 49 states combined and will undoubtedly suffer major climate impacts as the Arctic ice sheets continue to melt and sea levels rise. It is the federal government's responsibility to make sure that states like Alaska are planning for how they will deal with environmental changes instead of allowing short-sighted development gains blind them. By amending the CZMA to require, rather than encourage state participation, the federal government can be sure that states are preparing for the challenges ahead.

2. Enforcement Under the Coastal Zone Management Act

The CZMA has an approval process to ensure that state management plans are adequate.[190] What the Act does not have is a strong system for ensuring these plans are adhered to and translated into action. The CZMA should be amended to include stronger enforcement measures.

Under the CZMA, the Secretary must review and approve state management programs to be sure they meet the goals of the Act and a list of program elements.[191] Once approved, a state must seek the Secretary's permission before making any changes to its management plan.[192] This is an adequate approval process that ensures sound planning. Furthermore, if the goals of the CZMA were amended to be more specific, then the bar for approval would be raised, as well as the quality of the plan put in place.

The CZMA has accountability provisions but stronger measures are needed. NOAA conducts periodic evaluations of state management programs that assess accomplishments and include recommendations for program

189. Siders, *supra* note 92 at 26.

190. 16. U.S.C. § 1458.

191. 16 U.S.C. § 1454-1455.

192. 16 U.S.C. § 1455(16)(1).

enhancements.[193] During these evaluations there are opportunities for public comment and a final report is issued summarizing the evaluation.[194] This type of review is an example of a permissive process that does little to jumpstart states into action.[195] Under the CZMA, the Secretary can suspend or withdraw funding or revoke approval if a state fails to adhere to its management program.[196] Here, there is no need to amend the CZMA, the federal government can simply exercise the coercive authority it has already been granted.

Rather than reviewing programs and making recommendations for enhancements, NOAA should be in the practice of appraising management programs and putting those that are deficient on notice. If the goals of the CZMA are amended to include greater specificity, NOAA can then begin to pull funding for states that fail to meet specific objectives. Alternatively, NOAA could award funding on a competitive basis tied to state performance.[197] Similarly, the goals of the CZMA could include triggering mechanisms or benchmarks. For example, if sea level rise reaches a certain height, states could be required to execute certain development restrictions or risk a loss in funding. To date, the CZMA has been an inherently soft statute, but it contains provisions that, if better utilized, could give the statute some teeth.

3. Provisions for Coordinated Governance in the Coastal Zone Management Act

If the substantive provisions of the CZMA were revised to give more specific direction from the federal government to the states, then many of the procedural provisions could remain as written. At present, the CZMA does a lot to coordinate regulation between jurisdictional levels.[198] The CZMA also recognizes the need for federal support in the realms of scientific research and funding.[199] While the CZMA already has in place the channels for federal to state support, the federal government will need to significantly increase the amount of funding it makes available for the states and the extent to which it disseminates the most up-to-date research.

193. 16 U.S.C. § 1458(a).
194. *Id*.
195. Siders, *supra* note 92 at 29.
196. 16 U.S.C. § 1458(c)-(d).
197. 16 U.S.C. § 1458(c)-(d).
198. 16 U.S.C. § 1455(1)-(10).
199. 16 U.S.C. § 1456(c).

a. Intergovernmental Cooperation

The CZMA requires states to develop management programs that identify the means by which the state proposes to exert control over land and water uses.[200] Similarly, the CZMA requires proof that a state has the requisite authority to manage the coastal zone. This includes the authority to administer land and water use regulations that control development, and the authority to resolve conflict between competing users.[201] While the federal government may dictate specific adaption goals, each state will need to implement these substantive measures differently under their particular sets of laws. The CZMA already encourages states to think about what laws they will need to carry out in planning objectives.[202] Presumably many of the laws necessary for coastal management are useful for climate adaptation, so these provisions of the CZMA may be repurposed without revision.

Regarding intergovernmental cooperation between agencies, the CZMA requires state management plans to include a description of the organizational structure proposed to implement the management program, including the responsibilities and interrelationships of local, area wide, state, regional, and interstate agencies in the management process.[203] This means that states with approved Coastal Management Plans have already gone through the process of organizing and coordinating a governance structure within the state. Rather than enacting a new law that would impose its own cooperative governance requirements, decision makers should capitalize on the CZMA's system and fold adaptation planning into coastal management programs.

b. Information Sharing

If the federal government is going to delegate more specific, and likely more burdensome, regulatory objectives to the states, then it needs to provide extensive administrative support. The CZMA already requires the federal government to provide technical assistance and management-oriented research to the states.[204] Under the CZMA, the Secretary needs to coordinate research and make the results of pertinent studies available.[205] The Secretary must also consult with coastal states on a regular basis

200. 16 U.S.C. § 1455(2)(D).
201. 16 U.S.C. § 1455(10)(A).
202. 16 U.S.C. § 1455(1)-(10).
203. 16 U.S.C. § 1455(2)(F).
204. 16 U.S.C. § 1456(c).
205. 16 U.S.C. § 1456(c)(b)(1).

regarding the development and implementation of their management programs.[206]

The CZMA has established a system in which the federal government furnishes requisite information to the states as well as a channel through which the states can communicate scientific gaps or policy needs to the federal government.[207] In addition, the CZMA encourages each department, agency, and instrumentality of the executive branch of the Federal Government to assist the Secretary with technical assistance and management by sharing information or transferring personnel.[208] This provision of the CZMA encourages horizontal cooperation, which is ideal for maximizing federal recourses and making content available to the states. Furthermore, when the Secretary reports to the President and Congress about the state of the national program, this summary includes a list of outstanding problems under the CZMA, as well as recommendations for additional legislation.[209] Through this provision, the Secretary can help the states gain assistance from the Executive as well as Legislative branches.

The federal government, through the stewardship of NOAA, provides extensive online publications for program guidance, technical training, and scientific support.[210] NOAA's Digital Coast website provides data sets and trainings to help coastal communities apply this information.[211] NOAA also provides technical training to state officials through the Sea Grant Program: a network of more than 3,000 scientists, engineers, educators, students and outreach experts that work to address coastal management issues.[212]

The National Coastal Zone Management Program website provides extensive program guidance about how to enact and run a state coastal management plan.[213] Included among these publications is a report entitled *Adapting to Climate Change: A Planning Guide for State and Coastal Managers*, which

206. 16 U.S.C. § 1456(c)(b)(2).

207. 16 U.S.C. § 1456(c).

208. 16 U.S.C. § 1456(a).

209. 16 U.S.C. § 1462(c).

210. National Oceanic and Atmospheric Administration, *available at* http://www.noaa.gov/.

211. Office for Coastal Management, D*igital* Coast, (April, 2015) *available at* http://coast.noaa.gov/digitalcoast/.

212. National Oceanic and Atmospheric Administration, S*ea G*r*ant* P*rogram*, (April 2015) http://seagrant.noaa.gov/WhereWeWork/SeaGrantPrograms.aspx.

213. Office for Coastal Management, N*ational Coastal Zone* M*anagement* P*rogram*, (April 2015) http://coast.noaa.gov/czm/guidance/.

provides guidance to state actors on how to develop an adaptation plan.[214] The report provides an outline of the steps decision makers can follow to generate a plan, including assembling a planning team, conducting vulnerability assessments, considerations for adaptation strategies, implementation of a plan, and its maintenance.

This guide is an excellent resource for a proactive state with enough funding and scientific information to undertake the laborious planning process on its own. The report is much less useful for apathetic states or states like Alaska that elect not to participate in coastal management or adaptation efforts.

Altogether, NOAA provides considerable support and, through the horizontal cooperation provision of the CZMA, collaboration with other federal agencies for access to additional resources. The U.S. Global Change Research Program has a wealth of climate science, modeling, and mapping that could be coordinated by NOAA for use by the states.[215]

NOAA has also published a number of publications that demonstrate the federal government is receptive to state needs and the Act's provision for consultation between federal and state government is effective. [216] Altogether, the CZMA puts in place a system for the federal government to provide comprehensive assistance to the states—one that appears to be working.

c. Funding

An area where the federal government needs to do more is funding. There are four funding opportunities under the current CZMA that could be used for adaptation. First the CZMA has Administrative Grants, matching funds to states for the general administration of their management programs.[217] Second are Coastal Resource Improvement grants, specific land use grants to states for coastal preservation or restoration.[218] Third, Coastal Zone Enhancement Grants, specific grants to states with programs that meet special enhancement objectives including projects that address the impacts of climate change.[219] And finally, Coastal Nonpoint Pollution Control

214. NOAA, Office of Ocean and Coastal Resource Management, *Adapting to Climate Change: A Planning Guide for State Coastal Managers*, (2010) [hereinafter OCRM 2010], *available at* http://coastalmanagement.noaa.gov/climate/docs/adaptationguide.pdf.

215. *See generally* USGCRP 2014, *supra* note 4.

216. OCRM 2010, *supra* note 214 at 7.

217. 16 U.S.C. § 1455.

218. 16 U.S.C. § 1455(a).

219. 16 U.S.C. § 1456(b).

Programs, matching funds to states with established water quality programs.[220]

Based on these four provisions, there are plenty of avenues through which the federal government can transfer money to the states for the purposes of adaptation planning. The statutory mechanism is in place. The problem however, is the amount of money the CZMA makes available.

In 2013, NOAA allocated $61 million to the states through the CZMA, which was matched by $49 million from state and local sources.[221] A large portion of this money was used by the states for adaptation actions including $30 million for coastal restoration designed to buffer communities and habitat from storms; $15.9 million for minimizing risk from coastal hazards such as sea level rise; and $13.8 million for managing smart coastal development.[222]

While these numbers reflect a good starting point, and the spending patterns by the state show adaptation actions are a priority, $61 million from the federal government and $49 million from the states is nowhere near the total funding needed for effective adaptation.[223] Congress needs to at least double the allowance for the CZMA in order for the Act to sufficiently contribute to climate adaptation.

Obama's Administration has recently stepped up its commitment to climate preparedness by dedicating $1 billion for climate resilience projects under the National Disaster Resilience Competition.[224] Hopefully this type of significant and dedicated federal funding for adaption efforts continues.

4. Participation and Fairness under the Coastal Zone Management Act

The CZMA has a number of provisions for broad participation. However, the Act needs to be amended to include additional provisions for equitable adaptation. These should include risk assessments that identify the most vulnerable communities and prioritize their protection.

220. 16 U.S.C. § 1455(b).

221. NOAA, Office of Ocean and Coastal Resource Management, *Funding Summary* 2013, (April 2015), *available at* http://coastalmanagement.noaa.gov/resources/docs/czmp_funding_summary13.pdf.

222. NOAA, Office of Ocean and Coastal Resource Management, *Funding Summary* 2013, (April 2015), *available at* http://coastalmanagement.noaa.gov/resources/docs/czmp_funding_summary13.pdf.

223. Doremus, *supra* note 99 at 5.

224. Exec. Order 13653, *supra* note 66.

a. Broad Participation

The CZMA provides a number of opportunities for democratic participation. When a state develops its management plan it must provide notice and the opportunity for full participation from relevant federal agencies, state agencies, local governments, regional organizations, port authorities, and other interested parties and individuals both public and private.[225] Management plans need to establish an effective mechanism for continuing consultation between the state agency in charge of running the management program and local governments, interstate agencies, and regional agencies.[226] The state must provide notice to local governments if it plans to enact an ordinance that conflicts with local law and allow thirty-day period for comment.[227] A management program must also provide for public participation in permitting processes, consistency determinations, and other similar decisions.[228]

These provisions ensure broad participation from a variety of stakeholders throughout the planning process.[229] They also reflect bottom-up participation that affords local governments with the opportunity to contribute regional knowledge, giving stakeholders opportunities for input before new laws are passed.[230] Altogether, the CZMA has put in place a system for broad participation. Nevertheless, there is no mention of targeted outreach or efforts to incorporate the viewpoints of the underrepresented.

b. Fairness

The CZMA needs to be revised to include risk assessments that prioritize the protection of the most vulnerable coastal communities. There are only a few vague directions under the CZMA for states to evaluate risk or prioritize use. Under the Act, state management plans must provide an inventory of areas of particular concern within the coastal zone[231] and identify activities that receive priority use there.[232] What defines an "area of particular concern" or a "priority use" is left entirely to the discretion of the state.

The Act should be revised to require states to conduct risk assessments that evaluate the likelihood that an impact will affect a community, the

225. 16 U.S.C. § 1455(1).
226. 16 U.S.C. § 1455(3)(B).
227. 16 U.S.C. § 1455(3)(B).
228. 16 U.S.C. § 1455(14).
229. Kaswan, *Seven Principles for Equitable Adaptation*, *supra* note 119 at 45.
230. Hecht, *supra* note 116 at 635.
231. 16 U.S.C. § 1455(C).
232. 16 U.S.C. § 1455(E).

sensitivity of that community, and its capacity to cope. In addition, the CZMA should include a mandate to protect the most vulnerable communities.

At present, a state may determine that areas of particular concern are those with the highest land value or the most significant infrastructure. While states will obviously want to protect public safety in addition to economic investments, the safety of those with political influence may come before those with a weaker voice.[233] Certain communities may know how to lobby for state investments that will fortify and protect them from climate impacts. When one group secures scarce funding, however, others lose out.[234]

Adaptation plans must therefore stay ever mindful of these tradeoffs and strive to address the deeper social and institutional circumstances that perpetuate systematic disparity.[235] States should be required to create an inventory of areas of particular concern based on a consideration of the quality of housing stock, underlying health conditions, land elevation, financial recourses, race, age, geographic mobility and other physical and social factors that measure a community's vulnerability.[236]

V. Conclusion

Congress should amend the Coastal Zone Management Act to provide for clear, specific, and balanced goals that include measurable criteria and elements of principled flexibility. Including more specific goals means increasing the federal role under the CZMA. However, this change will immensely benefit adaptation planning among the states. Next, the federal government should better utilize the enforcement powers already granted by the Act to make sure that states are turning plans into actions. The federal government will need to provide increased support in the forms of scientific research and funding. Lastly, while the CZMA ensures broad participation, changes should be made to ensure adaptation is equitable. With these changes, and enough funding, the CZMA could be transformed into an effective national adaptation plan.

Climate change will continue to be a wicked problem that plagues our country for years to come. It will have to be tackled from multiple angles with numerous programs. While no one statute will provide a fix, it is important that we act immediately by utilizing existing legislation. Congress should muster its authority to amend the CZMA and give the nation one component of the federal adaptation program it so badly needs.

233. Hillemanns, *supra* note 117.

234. *Id*.

235. Kaswan, *Seven Principles for Equitable Adaptation*, *supra* note 119 at 42.

236. Hecht, *supra* note 116 at 636-640.